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FIG. 1.

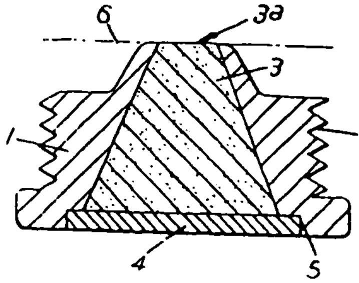

FIG. 2.

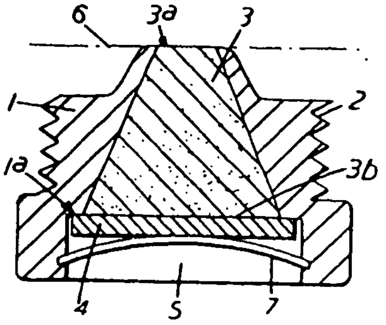

FIG. 3.

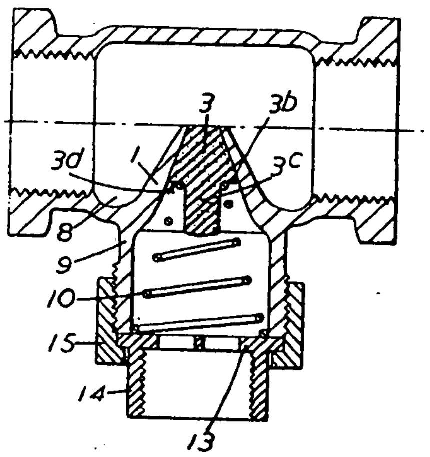

FIG. 4.

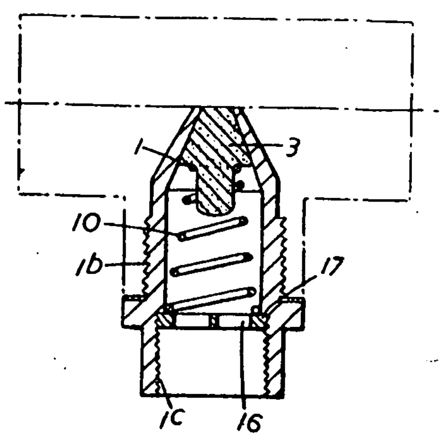

FIG. 5.

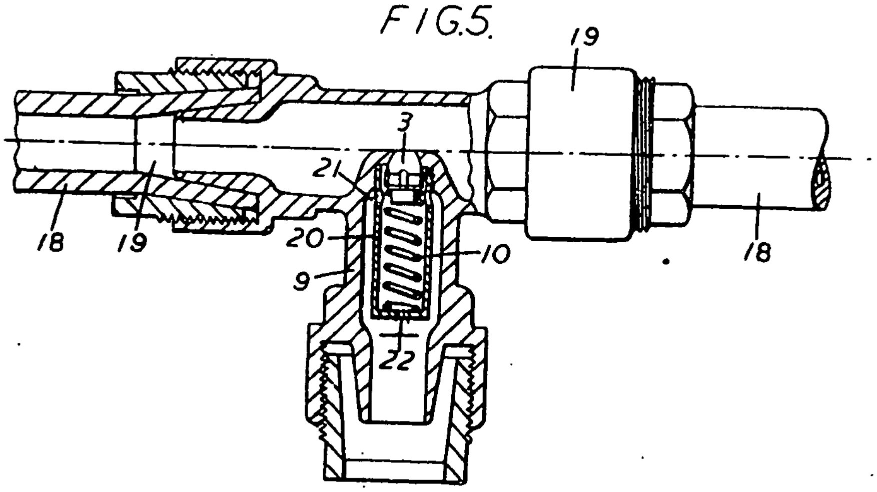

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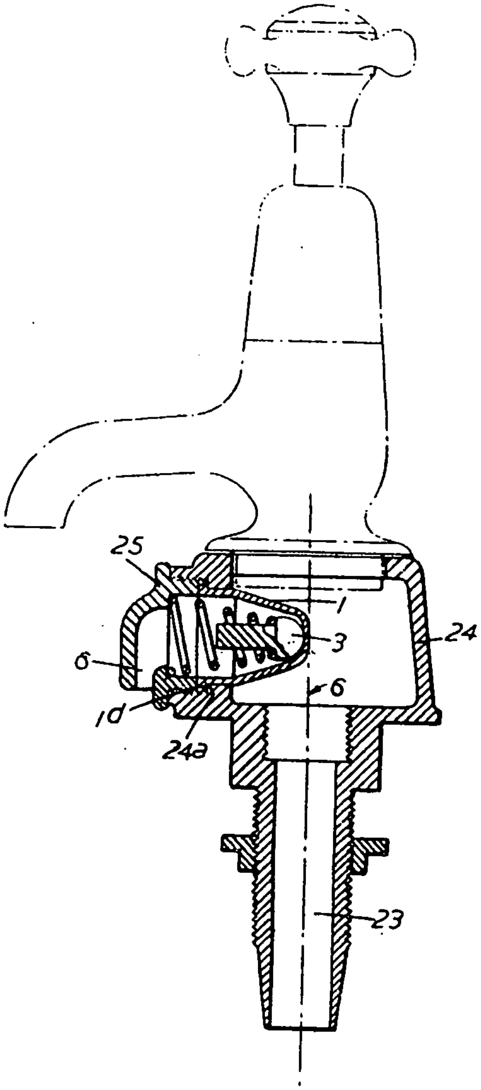
FIG.6.



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CANADA
THE PATENT OFFICE

PATENT No. 447,072 ISSUED MARCH 9, 1948

Device for the Prevention of Burst Pipes, Valves, Vessels and the Like Caused by Freezing

Frederick Charles August, Shirley, Surrey, England

Application March 14, 1945, Serial No. 524,509
Time to file extended under Patents, etc., Emergency Order, 1939

This invention relates to the employment of pressure relief valves for preventing damage to pipes and other containers for liquid, more particularly water, caused by freezing. Owing to the icing-up of the pipe or the like commencing from the external wall working inward it is not always certain that relief valves as hitherto proposed for the purpose will function properly when internal pressure has been built up due to freezing; the valve is invariably disposed completely on the outside of the pipe or container which it is employed to protect with its relief opening located at the inner surface of the wall to which the valve is attached. As a consequence the opening is liable to ice blockage and the movable parts of the valve liable to stick.

With the object of obviating or minimising the likelihood of such a defect the seating of the pressure relief valve body according to the present invention is carried interiorly into the pipe or the like so that the part of said body incorporating the seating projects from the inner surface of the wall of the pipe or the like and is immersed in the liquid and the valve aperture in said interiorly projecting body part is located away from the said inner surface.

In order that the invention may be clearly understood reference will now be made to the accompanying drawings which illustrate suitable ways and valve devices for carrying the invention into effect. On the drawings:—

Fig. 1 is a sectional view of a relief valve in its simplest form.

Fig. 2 is a view similar to Fig. 1 but showing a slight modification.

Fig. 3 is a sectional view showing the relief valve adapted to a fitting which can be incorporated in a screwed pipe line.

Fig. 4 is a sectional view showing how the relief valve may be fitted into a "Tee" piece or into a valve body or other container such as a hot water boiler or a water jacket of an engine, etc.

Fig. 5 is a part sectional view showing a modified form of the valve illustrated by Fig. 3 for insertion into a pipe-line, and

Fig. 6 shows how the relief valve may be attached to a tap according to the invention.

Referring first to Fig. 1 the relief valve comprises a hollow or tubular body 1 having an externally

threaded portion 2 by means of which it may be screwed into a pipe or other container not shown. As will be seen the bore of the valve tapers from its outer end to its inner end, the latter end, when the valve is fitted in position, being located away from the inner surface of the wall of the pipe or the like into which the valve has been screwed. Within the bore of the device is located a truncated cone shaped plug 3 which prevents egress of water or gas from the pipe or container but which does not offer any resistance to a predetermined pressure exerted thereon. The inner surface 3^a of the plug valve 3 is located, in the case of a pipe, on or about the centre line 6 of the pipe. The pressure on the valve plug 3 is resisted by a member 4 which is frictionally engaged within a recess 5 formed at the outer end of the fitting. The member which is a disc will resist the normal pressure of water flowing through the pipe, or alternatively the pressure of water within the container as the case may be, but will yield to a predetermined pressure within the pipe or container at the commencement of or during the formation of ice therein. The plug 3 can be made of any suitable material preferably of a non-absorbent or non-hygroscopic non-corrosive nature. Examples of a suitable material comprise rubber graphited asbestos, compressed fibre blocks, synthetic resin and other mouldable compounds. Assuming that the device is fitted to a pipe, and that the zone at which freezing will last take place will be around the centre-line 6 (which is normally the last zone of freezing in a pipe) then the pressure of water at the core or centre line of the pipe due to the expansion of water when freezing which will form at the wall of the pipe first and work inwards, will act on the surface 3^a of the plug 3 and will urge the latter outwardly eventually forcing the member 4 out of the recess 5. Thus the water under pressure within the pipe is free to escape and the pressure inside the pipe relieved so that the danger of the pipe being fractured or otherwise damaged is removed. The resistance to be offered by the member can be predetermined. Such resistance can be equal to the pressure created within the pipe when freezing first commences, or, where the device is fitted to a strong pipe or container it can be arranged that the member 4 will yield after a certain amount of freezing and at a correspondingly higher pressure.

The valve device shown in Fig. 2 is similar to that shown in Fig. 1 with the exception that the closure member **4** is urged against a shoulder 1^a of the body **1** and against the lower surface 3^b of the plug **3** by a bowed leaf-spring **7** which has its end fitted in notches formed in the recess **5** of the device. In this case the recess is deeper to form a housing for the spring **7** but it will be noticed that the member **4** is not a frictional fit therein. The spring **7** will return the plug to a closing position when pressure inside the pipe falls to a pressure lower than that exerted by the spring **7**.

Fig. 3 illustrates a modified form of the valve shown in Figs. 1 and 2 incorporated in a fitting adapted to be inserted in a pipe line. The fitting comprises a tubular body portion **8** and a lateral branch **9** which houses a coiled compression spring **10**. The body **1** of the valve is in this case made integral with the main body **8** and its branch **9** whilst the plug **3** in this case is formed with a depending part 3^c of smaller diameter than the diameter of the lower end 3^b of the plug, thus providing a shoulder 3^d against which the upper end of the spring **10** can engage. The lower end of the spring **10** seats upon a flange **13** provided at the upper end of a part **14** which is connected to the branch **9** by means of a ring **15**. The operation of the valve according to this embodiment of the invention is similar to that previously described with reference to Fig. 2. The plug **3** will be returned automatically after sufficient water has passed through the valve and the pressure within the pipe reduced to a value less than that exerted by the spring **10**. The body **1** may be separate and removable. The part **14** is threaded internally at its lower end for receiving the end of a pipe or other suitable means through which water passing through the device may be conducted to a suitable place.

Fig. 4 shows how the valve may be constructed in order that its use can be universal. It can be fitted for example to valve bodies and other containers such as a hot water boiler or the water jacket of an engine, etc. For the purpose of illustration Fig. 4 shows the valve fitted to a T-shaped pipe connection. In some respects it is similar to the device shown in Fig. 3 except that the body **1** is made longer and is capable of detachment. The plug is similar to the plug shown in Fig. 3 and is urged towards the inner end of the body **1** by a spring **10**. The valve body **1** is threaded externally as indicated at 1^b so that it can be screwed into the T connection while at its lower end it is threaded internally at 1^c in order that it may receive a ring **16** upon which the lower end of the spring **10** may seat and also to receive a pipe or other suitable means for conducting away the water passing through the device. Upward movement of the ring **16** is limited by a shoulder **17** formed by making the upper and lower parts of the body internally of different diameters. Excess pressure within the T connection will cause the plug **3** to be forced downwardly against the influence of the spring **10** which will reassert itself when the pressure is relieved within the pipe and so return the plug **3** to a closing position.

Fig. 5 illustrates a fitting intended for insertion between the ends of a lead pipe-line **18** and is in effect, a modification of the fitting shown by Fig. 3. According to Fig. 5, however, the opposing ends of the pipe **18** are received in coupling means designed specially for lead pipes and generally indicated at **19** and such a fitting **19** is also provided at the outer end of the branch **9**. As the means **19**

forms no part of the present invention no detailed reference will be made to it in this specification, it being sufficient to say that it enables a pipe to be connected to the fitting without having to wipe the joints. The valve in this embodiment comprises a cage **20** which is suspended co-axially within the lateral branch **9** and houses a coiled compression spring **10** which as in previous examples, engages the plug **3** and urges it into a closing position. When the plug **3** is moved against the influence of the spring **10**, due to pressure created in the pipe **18** by the formation of ice, water will pass the plug **3** and escape through ports **21** at the upper end of the cage and also through a hole **22** at the lower end of the cage.

Referring lastly to Fig. 6 of the drawings, this Figure shows the relief valve device according to this invention fitted to a tap. The relief valve is fitted between the valve of the tap and the supply pipe **23**, and is located in a housing **24** located between these parts. The inner end of the body **1** of the valve is located on the centre line **6** of the housing **24** and pipe **23** and the plug **3** is shown in this case as a mushroom type valve plug giving a quicker flow for a given lift. The body **1** is provided with a flange 1^d which is sandwiched between a flange 24^a on the housing **24** and the inner part of a cover **25** which is screwed into the housing **24**, the cover **25** having an opening **26** which permits water passing through the device to be conveyed into a bath, wash-basin or the like.

In all the foregoing examples it will be noticed that the inner end of the valve body containing the seating is always located adjacent to the core or centre line of the pipe.

Once water passes out of the pipe or container and pressure therein is reduced the possibility of breakage of the container due to freezing is overcome because the final amount of freezing in the pipe or container will not cause expansion as expansion only takes place when ice is at its mush or plastic state and at this stage it will act on the plug **3**.

In the event of ice forming in the pipe or container unequally or eccentrically in its final freezing a film or thickness of ice half the eccentricity is formed over the surface 3^a of the plug but the pressure due to expansion is more than sufficient to break this down.

It will be appreciated that the use of the devices hereinbefore described is not limited to the actual containers mentioned as the range of containers to which it could be applied is enormous. It can for instance be fitted to water mains, lavatories, steam traps (when not in constant operation), water pumping plants, sanitary fittings, radiators of all kinds, piping, water-closet pans, water jackets of engine cylinders, etc.

When carrying the seating of the valve body interiorly into the pipe or the like according to the invention, it is of course desirable to locate the inner end of the valve body in the container in the zone where freezing takes place last. When the invention is applied to lengthy water mains or long pipes it is desirable to fit the devices in a number of places best determined by an engineer bearing in mind always that the device should be fitted in a position between two stoppages (generally in the most exposed places) and/or between a point most liable to freeze and a valve or stop cock.

In determining a zone or zones where freezing is likely to occur last, this offers little or no difficulty to the engineer or plumber. It is obvious that with pipes and other containers exposed only to normal atmospheric conditions such a zone will be an area in the hollow body located most remote from the outside atmosphere. In a pipe this would obviously be a core along the axial centre and theoretically this core would become smaller and smaller as freezing takes place until it loses all dimension when coinciding with the centre line. With a pipe containing a wooden or other heat insulating surface the said core would be displaced somewhat towards said surface. In a container of irregular shape, the zone or zones remote from atmosphere would either be readily apparent or could be determined thermometrically or by other tests. For example in the water jacket of a multicylinder engine block it is well known that freezing first occurs towards the top, and consequently one zone at which the present device would be fitted would be towards the bottom of the block between adjacent cylinders of the engine. Considerations of this nature are well known to those skilled in the art and the zone or zones can be easily determined, with or without experiment, according to the circumstances of each particular case or type of case.

What I claim is:

1. A pressure relief valve for preventing damage to liquid containing vessels or pipes in the event of freezing, comprising a valve body extended interiorly into the pipe or vessel, valve means within said valve body and means yieldingly to hold said valve in the closed position, and to permit same to yield to expansion of the liquid in the event of freezing.

2. A pressure relief valve for preventing damage to liquid containing vessels or pipes in the event of freezing, comprising a valve body having an opening within the pipe or vessel, closure means and means yieldingly to hold said closure means in the closed position while permitting release in the event of expansion of the liquid due to freezing.

3. A pressure relief valve for preventing damage to liquid containing vessels or pipes in the event of freezing, comprising a valve body having an opening located at about the centre of the mass of the water in said pipe or vessel, closure means within said valve body and means yielding to close said closure means while permitting the valve to yield to expansion of the liquid in the event of freezing.

4. In conjunction with a water conduit, a relief valve to prevent damage due to freezing having an opening carried to a point interiorly of the conduit to about the centre thereof and release means operable by excess pressure of the liquid due to freezing.

5. In conjunction with a water container a relief valve to prevent damage due to freezing, comprising a valve body carried interiorly in the container and having an opening at a point therein near the middle of the container at the point which would be the last to freeze and release means associated with said valve to yield to the increased pressure of liquid in the event of freezing.

6. In conjunction with a water jacket for an internal combustion engine, release means to prevent damage due to freezing comprising a valve body having a part projecting inwardly of the jacket and having an opening well within said jacket and release means within said valve body to yield to the pressure of the liquid in the event of freezing.

7. A pressure relief valve for preventing damage to a water system due to freezing comprising a hollow body having a forward extension and adapted to be mounted in the water system so that said extension projects into the mass of water, said body having an aperture at the forward end thereof opening into a valve seating space, a closure plug located within such seating space and means yieldingly to hold said plug in the closed position in relation to said valve seating space while permitting same to yield to the excess pressure in the event of freezing.

8. A pressure relief valve for preventing damage to a water system due to freezing comprising a hollow body having a forward extension and adapted to be mounted in the water system so that said extension projects into the mass of water, said body having an aperture at the forward end thereof opening to a valve seating space, a closure plug located within such seating space and means comprising a frictionally held element in the body of the valve to hold the closure plug in position except when excessive pressure is applied in the water system due to expansion on freezing.

9. A pressure relief valve for preventing damage to a water system due to freezing comprising a hollow body having a forward extension and adapted to be mounted in the water system so that said extension projects into the mass of water, said body having an aperture at the forward end thereof opening into a valve seating space, a closure plug located within such seating space and means resiliently to hold said plug in the closed position, said means comprising a spring stressed to withstand normal water pressure but to permit release of the plug in the event of excess pressure due to freezing.

10. A relief valve adapted to be fitted in a line of water piping comprising a coupling union having a lateral branch therein, a projecting portion of said lateral branch extending to about a mid-point of the pipe area and having an opening adjacent said mid-point, a plug within said lateral branch and resilient means to maintain said plug on its seating while permitting said plug to unseat in the event of excess pressure due to freezing in the pipe.

11. A pressure relief valve to prevent damage in water systems in the event of freezing comprising a valve body screwed to fit a coupling embodied in said system and having an inwardly directed portion projecting into the water body and having an inlet at its extremity, a plug within said valve body, the extremity of said plug coming flush with said inlet, a spring within said body adapted to retain said plug in the closed position but to yield to excess pressure in the event of freezing and retaining means to support said spring, said retaining means comprising an apertured disc threaded into the body.

12. A coupling union for ductile composition pipes and including means to prevent damage due to freezing in said coupling union, embodying means to grip two lengths of pipe and to form a coupling in relation thereto, a projection within said coupling union having an opening within the mass of water within said union, a closure plug within said projection, spring means to maintain said plug in closed position against normal water pressure, but to release in the event of excessive pressure due to freezing, and an outlet means from said valve.

13. A faucet having in the water inlet portion thereof a pressure relief valve to prevent damage due to freezing, said relief valve comprising a body projecting into the mass of water and having

an inlet within said water mass, a plug within said body and spring means to hold said plug in the closed position and to resist normal water pressure but to be unseated in the event of excessive pressure due to freezing.

14. A coupling union for attachment to a water supply pipe at one end and to a faucet or other outlet fitting at the other end comprising inlet and outlet connections and an inwardly directed lateral projection in said union and presenting an aperture at about the centre of the water mass, a closure plug seating in said aperture, spring means to maintain said closure plug in the closed position, but to release in the event of excessive pressure due to freezing and an outlet from said lateral projection.

15. A pressure release device to prevent damage from freezing in water cisterns comprising an element projecting into the mass of water, said element having an inlet for water at the extremity thereof, a coned valve seating therein, a closure plug co-operating with said coned seating and adapted to be opened under the influence of water pressure and yieldable means to close said plug, said means being designed to hold said plug closed against normal water pressure but to release in the event of excessive pressure due to freezing.

16. A pressure relief valve for water systems comprising a valve body having a coned seating and projecting into the mass of water of said system, a resilient plug in the said coned body and adapted to close the outlet from said coned seating and spring means to maintain said plug in the closed position, said spring means being so designed as to resist normal water pressure but to release in the event of excessive pressure due to freezing.

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